REMARKS/ARGUMENTS

In the Office Action, the Examiner noted that claims 1-22 are pending in the application. The Examiner additionally stated that claims 1-22 are rejected. By this amendment, claims 1, 9, and 14 have been amended. Hence, claims 1-22 are pending in the application.

Applicant hereby requests further examination and reconsideration of the application, in view of the foregoing amendments.

In the Specification

Applicant has amended the specification to secure a substantial correspondence between the claims amended herein and the remainder of the specification. No new matter is presented.

In the Claims

Rejections Under 35 U.S.C. §103(a)

The Examiner rejected claims 1-22 under 35 U.S.C. 103(a) as being unpatentable over Mittal et al., U.S. Patent No. 5719800 (hereinafter, Mittal), in view of Browning, U.S. Patent No. 6415388 (hereinafter, Browning). Applicant respectfully traverses the Examiner's rejections.

With reference to claim 1, the Examiner noted that Mittal teaches the apparatus including:

- a plurality of functional units each including a corresponding plurality of activity outputs, for indicating when a respective functional unit is enabled [105 and 501, figs. 1 and 5]
- utilization assessment logic, coupled to said plurality of activity outputs, for assessing activity thereof to determine a current total power consumption value for the microprocessor [col. 5 lines 30-42 and col. 11 lines 54-58].
- power control logic, coupled to said utilization assessment logic, for comparing said current total power consumption value with a threshold power value included in a specified power profile, wherein a select signal directs said power control

logic to select said specified power profile from a plurality of profiles that are store within said power control logic [col. 5 lines 30-42 and col. 11 lines 54-58]. The examiner parenthetically remarked that although a select signal is not explicitly taught, Mittal teaches engaging one of a plurality of power modes (i.e., power profile) in response to the utilization (i.e. power consumption) being greater or less than a threshold value, and that in order to trigger this response, it is obvious if not inherent that a signal would have to be generated in order to select the appropriate power mode. The Examiner added that in addition, because the mode controller (107/502) initiates the change between a normal and reduced power mode without any explicit teaching of loading the power mode settings (i.e., power profile) from outside the mode controller, it is interpreted that the power profiles selected by the power control logic are selected from profiles stored within the power control logic.

- a power consumption controller, coupled to said power management logic and said plurality of functional units, for engaging one of a plurality of power reduction modes if said current total power consumption value exceeds said threshold power value [abstract and col. 5 lines 25-29]. The Examiner added that because the activity monitor and mode controller compare the power consumption value with a threshold value, selects a power mode in response to the comparison and engages that power mode, it is interpreted that the activity monitor and mode controller comprises the utilization assessment logic, power control logic and power consumption controller as they perform the same functions.

The Examiner conceded that Although Mittal implicitly teaches a select signal for selecting between power modes, it is not explicitly taught to have a select signal for selecting one of a plurality of power reduction modes to be engaged if the current total power consumption value exceeds said threshold power value, but that Browning teaches selecting a power mode from a plurality of power modes including a plurality of power reduction modes [figs. 6 and 7 and cols. 5-7 lines 64-8]. To summarize, The Examiner stated that Browning teaches having multiple temperature thresholds and initiating a power mode based on the current temperature noting, for example, when the temperature

or power consumption of a processor is below threshold Tl, the processor enters a first high power/performance state, and when the processor temperature or power consumption is above threshold Tl but below threshold T2, the processor enters a second power/performance state that is lower than the first high power/performance state. Finally, the Examiner stated that if the temperature or power consumption of the processor is above threshold T2, the processor enters a power/performance state that is even lower than the second power/performance state. Accordingly, the Examiner concluded that it would have been obvious to one of ordinary skill in the art to include the plurality of reduced power states and to generate a selection signal to select one of the reduced power states to be engaged, by power control logic and power consumption controller (i.e., activity monitor and mode controller), because it would obviously introduce varying degrees of performance throttling based on necessity, thus optimizing system performance. In particular, the Examiner opined that supplying just a single lower power mode does not optimize system operation, noting that if running a processor at a maximum rate and the temperature begins to overheat just slightly, an aggressive power reduced mode may not be necessary, and by including a reduced power mode that is not as aggressive, power consumption and temperature can be reduced while still providing substantial performance. The Examiner noted on the other hand if running the same processor at the same maximum rate and the processor begins to experience substantial overheating, the same aggressive power reduced mode would be necessary to rapidly reduce the temperature and power consumption at the expense of performance to prevent imminent damage to the processor circuitry, and by providing varying degrees of performance, the system can maintain optimal performance given its current operating environment.

Applicant respectfully disagrees with the Examiner's rejection of claim 1 for the following reasons. First, Mittal teaches a technique that allows an IC to dynamically make the tradeoff between high-speed operation and low-power operation, by throttling back performance of a function unit when its recent utilization exceeds a sustainable level. Thus, the technique allows the IC to dynamically throttle back the execution rate of maximum worst-case power consumption sequences of operations so as to not exceed

the worst-case power consumption allowable, thus avoiding reliability, heat dissipation, or power supply problems. (col. 4, lines 19-28) If the activity level is greater than a threshold, then a functional unit is operated in a reduced-power mode. The threshold value is set large enough to allow short bursts of high utilization to occur without impacting performance. (Abstract) Mittal states that "the validity of these or any other premises about the best techniques for optimizing performance in the context of worst-case power conservation is preferably determined by profiling the realistic worst-case power benchmark described above. (col. 12, lines 18-22). Thus, Mittal obviously teaches how to throttle performance of functional units to a level that does not exceed a worst-case power consumption value.

Furthermore, Mittal does not measure the power consumed by a functional unit, but rather monitors an activity level of the unit and infers power consumption therefrom. For example, Mittal's activity monitor tracks the recent utilization of a particular functional unit within the IC by, for example computing its average duty cycle over its recent operating history. (col. 3, lines 18-22) Mittal proposes profiling the power consumption of sequences of operations in a mix of popular software programs, and choosing from among those sequences the sequence with the highest power consumption. (col. 4, lines 49-57) This is the sort of coarse power estimation technique that the present inventor has noted is disadvantageous and for which the present invention is proposed to overcome.

Mittal furthermore states that functional unit 105 provides current activity information 108 to activity monitor 106, and that current activity information 108 describes *what tasks or operations functional unit 105 is currently performing, or indicates that it is currently idle.* Based on this current activity information 108, activity monitor 106 generates activity level 108 and provides it to mode controller 107. The inventor discloses that activity level 109 could be a number, a set of signal each indicating the activity level is within a specified range, or even a single bit. The activity monitor monitors the activity level 109, which could be a special signal generated by the functional unit 105, or it could simply be the commands that functional unit 105 receives and responds to. (col. 3, lines 30-43)

From the above teaching of Mittal, one skilled in the art would clearly appreciate that what Mittal's invention is intended to address is utilization, and that Mittal's functional units provide only a coarse indication of activity, such as the commands received or the average duty cycle over its recent operating history.

In contrast, amended claim 1 recites a plurality of functional units each including a corresponding plurality of activity outputs, for indicating when a respective functional unit is enabled, and for dynamically indicating how much power said respective functional unit is consuming. That is, each of the activity outputs indicate power consumed, not activity. This is clearly disclosed in the instant specification in paragraphs 0037 through 0040, where the value of a particular activity signal according to the present invention indicates power consumption (i.e., watts) from which a total power consumption is computed and addressed. Consequently, the present invention provides for a direct measurement of power consumed, as opposed to the coarse estimation of utilization which is taught by Mittal.

Regarding Browning, Applicant respectfully asserts that the inventor only teaches Browning teaches selecting a power mode from a plurality of power modes including a plurality of power reduction modes, and these are employed as a function of device temperature. However, Browning provides no motivation whatsoever to support indicating the power consumed by a functional unit via an activity signal, as is provided for in claim 1. Moreover, the combination of Mittal and Browning fails to teach, suggest, or even hint that a functional unit may provide an activity signal that indicates the power that it is consuming, thus providing for a finer measurement of overall device power consumption.

Accordingly, and in view of the points asserted above, it is respectfully requested that the rejection of claim 1 be withdrawn.

With respect to claims 2-8, these claims depend from claim 1 and add further limitations that are neither anticipated nor made obvious by Mittal, Browning, or Mittal and Browning in combination. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 2 and 6-8.

The Examiner also rejected claims 9 and 14 of the same basis as was set forth in the rejection of claim 1. Applicant notes that both claims 9 and 14 contain substantially similar limitations as claim 1 directed towards dynamically indicating how much power a respective functional unit is consuming, which have been argued above as being allowable over Mittal and Browning. Therefore, it is requested that the rejections of claims 9 and 14 be withdrawn as well.

With respect to claims 10-13, these claims depend from claim 9 and add further limitations that are neither anticipated nor made obvious by Mittal, Browning, or Mittal and Browning in combination. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 10-13.

With respect to claims 15-22, these claims depend from claim 14 and add further limitations that are neither anticipated nor made obvious by Mittal, Browning, or Mittal and Browning in combination. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejections of claims 15-22.

CONCLUSIONS

Applicant believes this to be a complete response to all of the issues raised in the instant office action and further submits, in view of the amendments and arguments advanced above, that claims 1-22 are in condition for allowance. Reconsideration of the rejections is requested, and allowance of the claims is solicited.

Applicant also notes that any amendments made by way of this response, and the observations contained herein, are made solely for the purpose of expediting the patent application process in a manner consistent with the PTO's Patent business Goals (PBG), 65 Fed. Reg. 54603 (September 8, 2000), and are furthermore made without prejudice to Applicant under this or any other jurisdictions. It is moreover asserted that insofar as any subject matter might otherwise be regarded as having been abandoned or effectively disclaimed by virtue of amendments made herein and/or incorporated in attachments submitted with this response, Applicants wishes to reserve the right and hereby provides notice of intent to restore such subject matter and/or file a continuation application in respect thereof.

Applicant earnestly requests that the Examiner contact the undersigned practitioner by telephone if the Examiner has any questions or suggestions concerning this amendment, the application, or allowance of any claims thereof.

I hereby certify under 37 CFR 1.8 that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office on the date of signature shown below.

Respectfully submitted,
HUFFMAN PATENT GROUP, LLC

/ Richard K. Huffman /

By: _____

RICHARD K. HUFFMAN, P.E.
Registration No. 41,082
Tel: (719) 575-9998

01 / 30 / 2008

Date: _____